

# Management of Empyema Thoracis in Children: Tube Thoracostomy Versus Early Decortication

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## ABSTRACT

*Objective* To compare the morbidity and functional outcome of tube thoracostomy and early decortication in the management of empyema thoracis in children.

*Study design* Comparative study.

*Place & Duration of study* Department of Paediatric Surgery, Bahawal Victoria Hospital Bahawalpur, from September 2009 to June 2010

*Methodology* A total of 60 cases were included in the study and divided into two groups, each having 30 patients. Group A was managed by tube thoracostomy while group B was managed by early decortication following tube thoracostomy. Radiological lung re-expansion and hospital stay in days were calculated and subjected to statistical analysis.

*Results* In group A 16 (53%) patients were males and 14 (46%) females. Out of these 10 (33%) patients between 1-4 years of age. In group B 12 (40%) patients were males, with 11 (36%) patients between 1-4 years of age. Mean hospital stay was 15.23 days in tube thoracostomy group and 8.33 days in early decortication group. Radiological lung re-expansion in patients treated with tube thoracostomy (group A) was seen in 18 (60%) patients. In group B radiological lung re-expansion was noted in 24 (80%) patients.

*Conclusion* Morbidity of early decortication in the management of empyema thoracis in children of 12 years and below was less than the tube thoracostomy with better radiological outcome.

*Key words* Empyema thoracis, Tube thoracostomy, Decortication.

## INTRODUCTION:

Empyema thoracis is a common surgical complication of pneumonia. It is an important cause of paediatric hospital admissions and paediatric morbidity. Various modes of treatment are described for the management of this condition. The proper management of empyema thoracis in children continues to be a source of debate. Thoracic empyema continues to have a high mortality rate (10-16%)<sup>1</sup>. It occurs when bacteria invade and propagate in the normally sterile pleural space, and

progresses in three phases. The exudative phase is caused by increased permeability of the inflamed pleura. The fibrinopurulent phase is characterized by accelerated fibrin deposition, giving rise to loculations and pus formation. The organizational phase begins one week after infection and is characterized by multiloculated empyema and pleural peel, with subsequent lung entrapment. The predominant organisms involved are staphylococcus, streptococcus, and mycoplasma species.

Various treatments have been employed, including antibiotics, thoracentesis, tube thoracostomy, intrapleural fibrinolytics, open-window thoracostomy, video-assisted thoracoscopic surgery, and thoracotomy. When tube thoracostomy is successful, drainage is 83% complete in three days.<sup>2</sup> However, complicated cases will require multiple chest tubes

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and there is a 25% to 80% chance of treatment failure.<sup>3,4</sup> Open drainage is achieved by drain tube thoracostomy, rib resection, an Eloesser's flap, or a Heimlich valve. These maneuvers enable continuous drainage without hampering ambulation. The incidence of permanent sequelae in empyema thoracis is low to absent.<sup>5</sup> Pleural opacity resolves by 2-16 months.<sup>6,7</sup> There is no permanent lung function abnormality, and the long-term prognosis is excellent.<sup>2</sup> The current mode of therapy in our institution is conservative, utilizing tube thoracostomy alone.

Although there are now reports that favor early aggressive surgical therapy, there is still neither internationally accepted protocol nor randomized controlled trials of the management of paediatric empyema. This study assessed the outcome of early decortication when compared with tube thoracostomy for thoracic empyema in children.

**METHODOLOGY:**

All the cases of empyema thoracis admitted in the Department of Paediatric Surgery, Bahawal Victoria Hospital Bahawalpur, from September 2009 to June 2010 were included in this comparative study. Consecutive sampling technique was used to select 60 eligible cases. They were divided into two groups (A and B) comprising of 30 each. Children of age 12 years and below having empyema thoracis were included. Diagnosis was established on the basis of history, examination and investigations including x-ray chest with any of the two findings taken as significant (lung collapse with pleural effusion, multiloculated fluid collections, shift of mediastinal structures). Patients with associated lung disease like tuberculosis, lung abscess and malignancy etc. and patients with previous chest surgery were excluded.

The demographic characteristics of study population were noted. Parents were informed about the objectives and informed written consent taken. Allocation to either of the groups was done randomly by choosing from two folded slips bearing letters A

and B. Patients were also matched for age, nutritional status and gender so as to minimize the effects of confounders. Group A was managed by tube thoracostomy and group B by early decortication.

In group A tube thoracostomy was done using appropriate sized chest tube between 3<sup>rd</sup> to 4<sup>th</sup> intercostal space anterior to mid axillary line. X ray chest was performed after every 48 hours to assess the lung re-expansion up to 10<sup>th</sup> post-operative day. On the basis of lung re-expansion functional outcome was measured. At 6 weeks after intervention final outcome was measured. In group B open thoracostomy was done. Fibroplurulent fluid or fibrous peel of infected material along with parietal pleura was separated through posterolateral approach followed by insertion of chest tube. Functional outcome was measured on the same lines as in group A. Final outcome was measured at 6 weeks after the intervention and was labeled positive if lung re- expansion found to be 50% from the base line.

Data was analyzed using the computer software SPSS version 11. Descriptive statistics were used to calculate mean and standard deviation for the variable like hospital stay. Frequency was calculated for lung re-expansion. Student t test was used as test of significance to compare the difference in mean hospital stay. Chi square test was used to compare the frequency of lung re-expansion between two groups. The level of statistical significance (alpha) was taken as 0.05.

**RESULTS:**

In group A 16 (53%) patients were males and 14 (46%) females. Out of them 10 (33%) patients were between ages 1-4 years, 12 (40%) of 5-8 years while 8 (26%) patients were between 9-12 years. In group B 12 (40%) patients were males and 18 (60%) females. Out of 30 patients in group B 11 (36%) were between ages 1-4 years, 9 (30%) of 5-8 years while 10 (33%) were 9-12 years of age. Length of hospital stay and radiological lung re-expansion are given in the table I and table II respectively.

Variable (days of hospital stay)	1-4	5-9	10-14	>14	Mean Hospital Stay (days)	Standard Deviation	Standard Error of Mean
Tube thoracostomy (n)	0	3	11	16	15.23	4.39	0.801
Early decortication (n)	4	19	6	1	8.33	3.31	0.605

P value= 0.00

**Table II: Lung Re-expansion in Tube Thoracostomy and Early Decortication**

Lung Re-expansion	YES	NO
GROUP A	18 (60%)	12 (40%)
GROUP B	24 (80%)	6 (20%)
TOTAL	42 (70%)	18 (30%)
Chi square 2.857 P value 0.091		

**DISCUSSION:**

Bacterial pneumonia is the most common cause of thoracic empyema in the paediatric age group. Pleural effusion during the course of nonspecific bacterial pneumonia progresses to empyema for several reasons including malnutrition, immunodeficiency, irregular antibiotic treatment, delay in diagnosis of pneumonia, contamination during thoracentesis, the tendency for antibiotic treatment in the acute phase in paediatric clinics, and disappearance of the signs and symptoms of pneumonia.<sup>8</sup>

There are many treatment options but unfortunately results with these treatment regimens have been highly variable. As a result, the optimum therapeutic strategy for empyema has yet to be elucidated. Moreover, the availability of non-operative alternatives frequently results in delayed surgical consultation, and ultimately, increased patient morbidity and mortality.<sup>8,9,10</sup> Determination of the stage of the empyema has been reported to be crucial in choosing an appropriate therapeutic option. Duration of symptoms has been suggested as one of the means of estimating the stage of the empyema.<sup>9</sup>

In complicated para-pneumonic effusion, both serial thoracentesis and chest tube drainage can be advocated as a first-line therapy. There have been some reports of the effectiveness of this procedure after early diagnosis.<sup>11,12</sup> Tube drainage is recommended in children because of its reliability, rather than multiple thoracentesis.<sup>13</sup> Pleural lavage via the chest tube is useful for augmenting drainage and mechanical clearance and various antimicrobial agents can be added to the washing fluid.<sup>8,11</sup> LeMense et al<sup>14</sup> have suggested that this decreases the severity of pleural sepsis while instituting further therapy. We have not used any agent for lavage purposes after chest tube placement.

Because of the low reported success rate of tube thoracostomy for loculated empyema, alternative approaches have been developed. Intrapleural fibrinolytic agents (IPFA) have been used in the

treatment of thoracic empyema.<sup>15</sup> Several reports have documented successful drainage of multi-loculated empyema using streptokinase and urokinase.<sup>13,16</sup> Temes<sup>17</sup> used IPFA in all 26 patients sent for decortication. More than two-thirds of patients with traditional indication for decortication for empyema thoracis were treated successfully. We have no experience of using this mode of treatment which appears feasible in early stages of the disease.

The presence of a thick rind with trapped lung are indications for operation and decortication.<sup>8,11,14</sup> The inability to evacuate fibrinous debris via chest tube is also an indication for decortication. Decortication should be performed as soon as possible if drainage is not effective. It may be an initial treatment instead of wasting time by performing tube thoracostomy. When the patient's status is suitable for surgery, we recommend this approach because of the decrease in mortality and morbidity, reduction of hospital stay, and discharge of the patient without an open wound. Postoperative complications such as atelectasis and delayed expansion are mainly from parenchymal disease. The results of our study are comparable to that of Brohi et al<sup>18</sup> but are somewhat different from that of Light et al.<sup>10</sup>

**CONCLUSION:**

Early decortication gives better results in terms of lung re-expansion and hospital stay when compared with tube thoracostomy.

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